

No. 702,755.

Patented June 17, 1902.

W. F. WILMOTH.  
FURNACE.

(Application filed Oct. 18, 1901.)

3 Sheets—Sheet 1.

(No Model.)

Fig. 2,

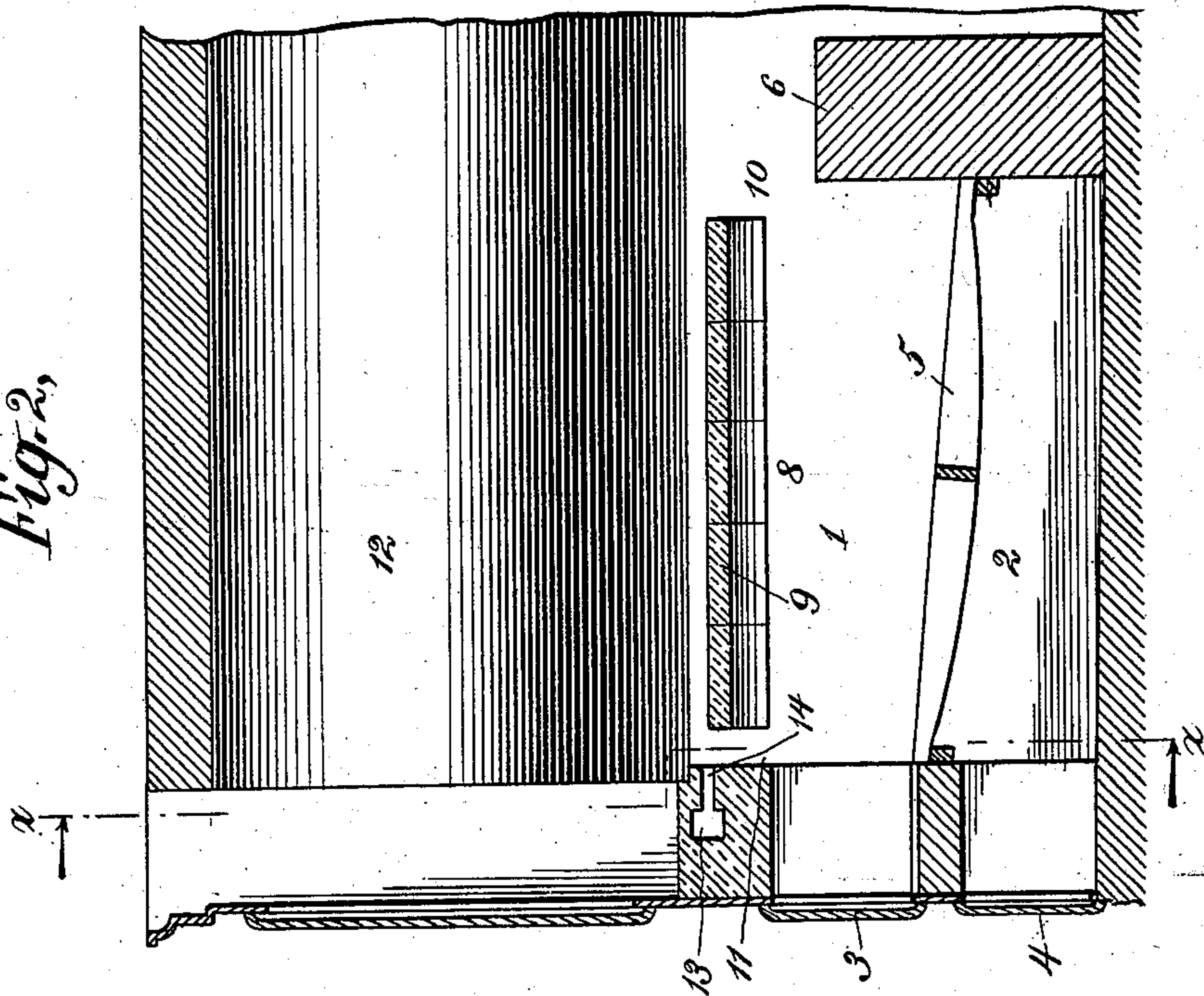
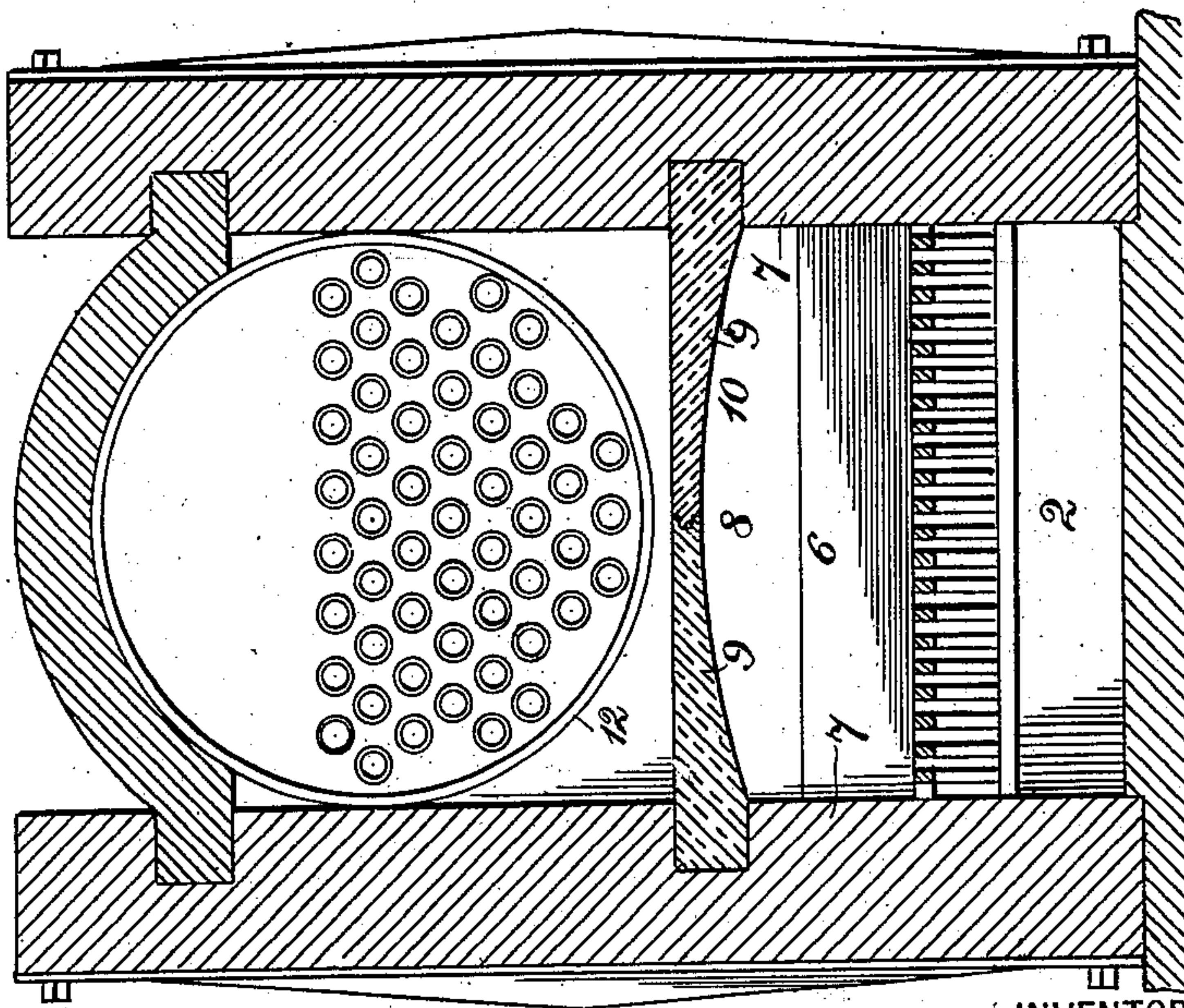


Fig. 1,



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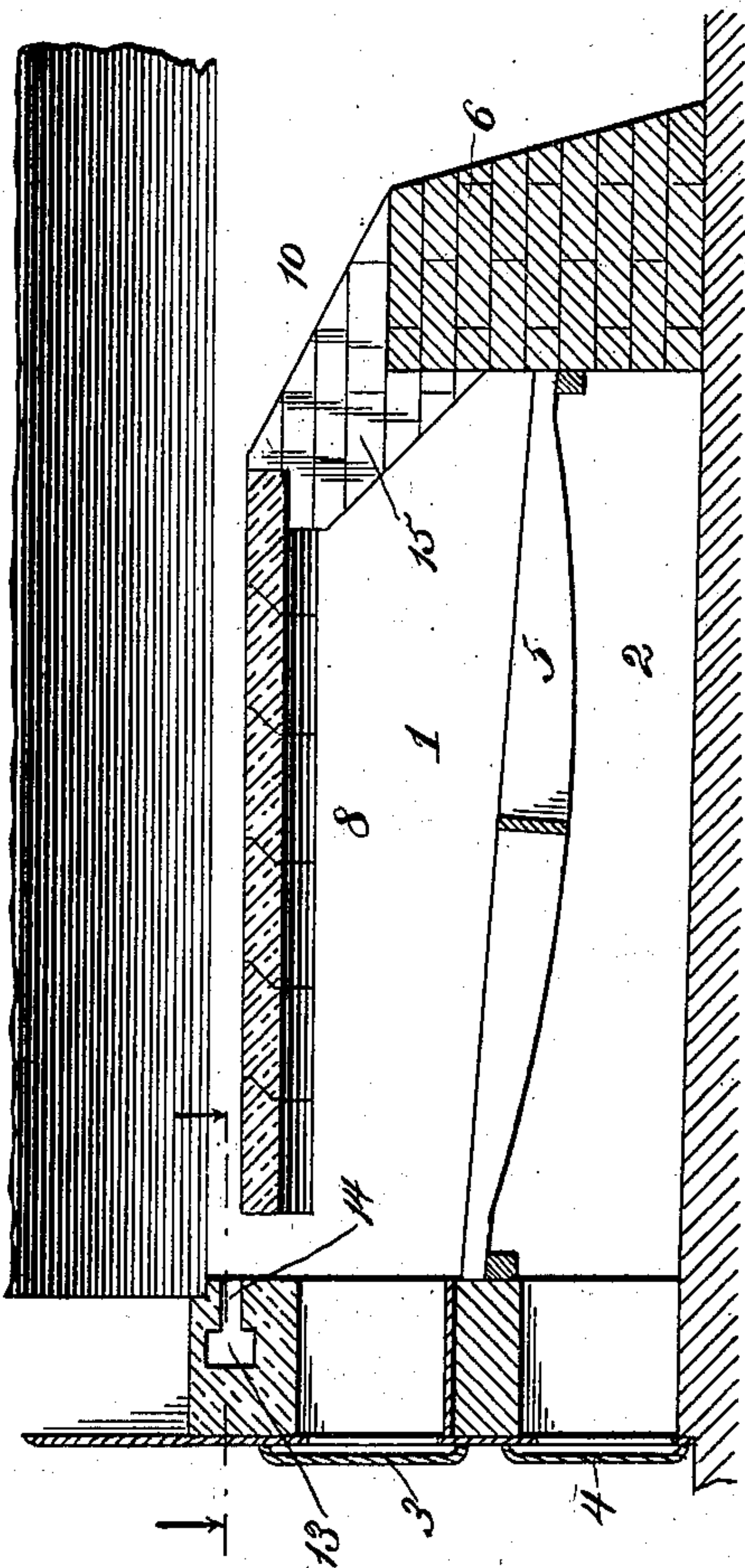


Fig. 3.

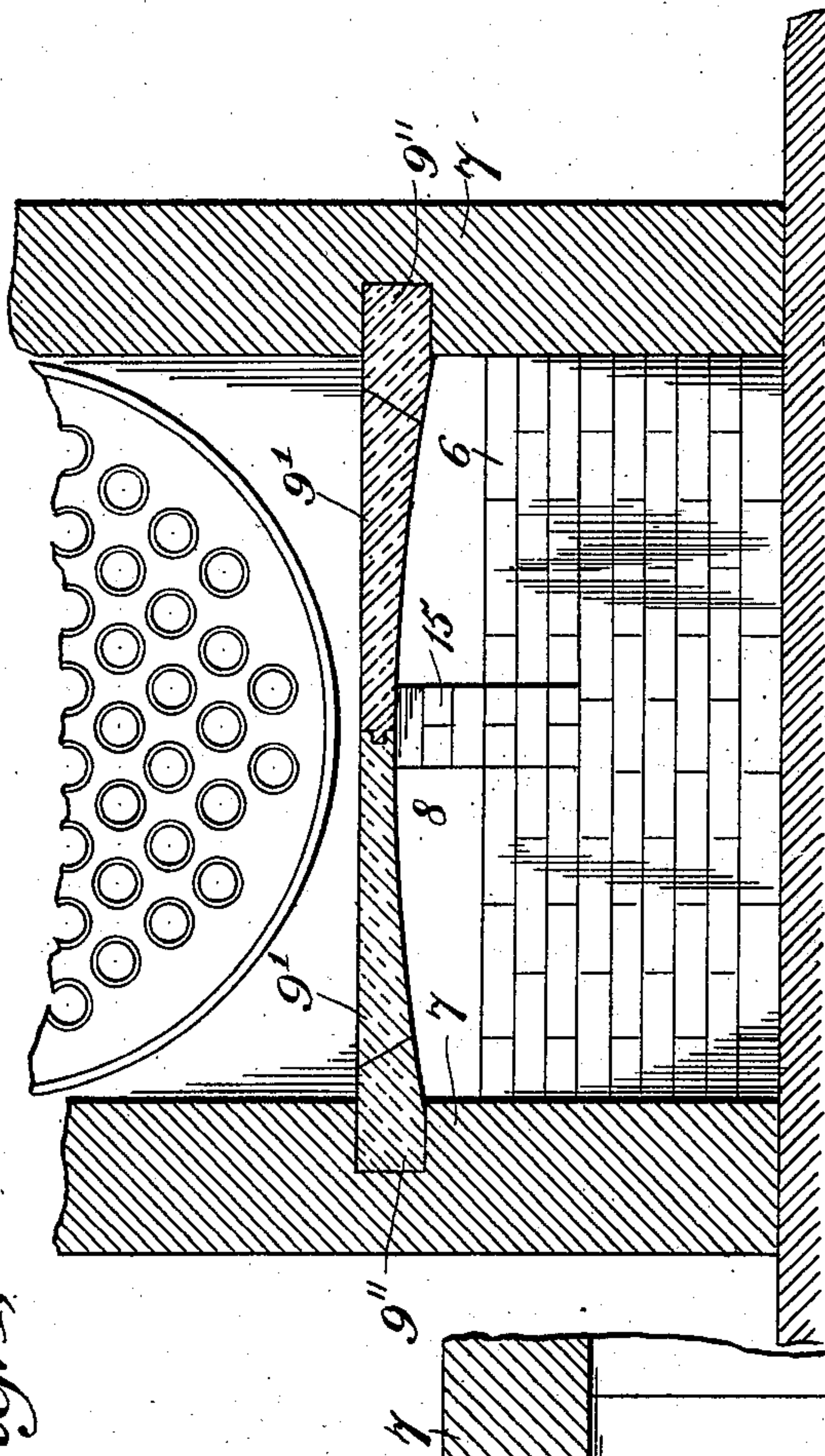


Fig. 4.

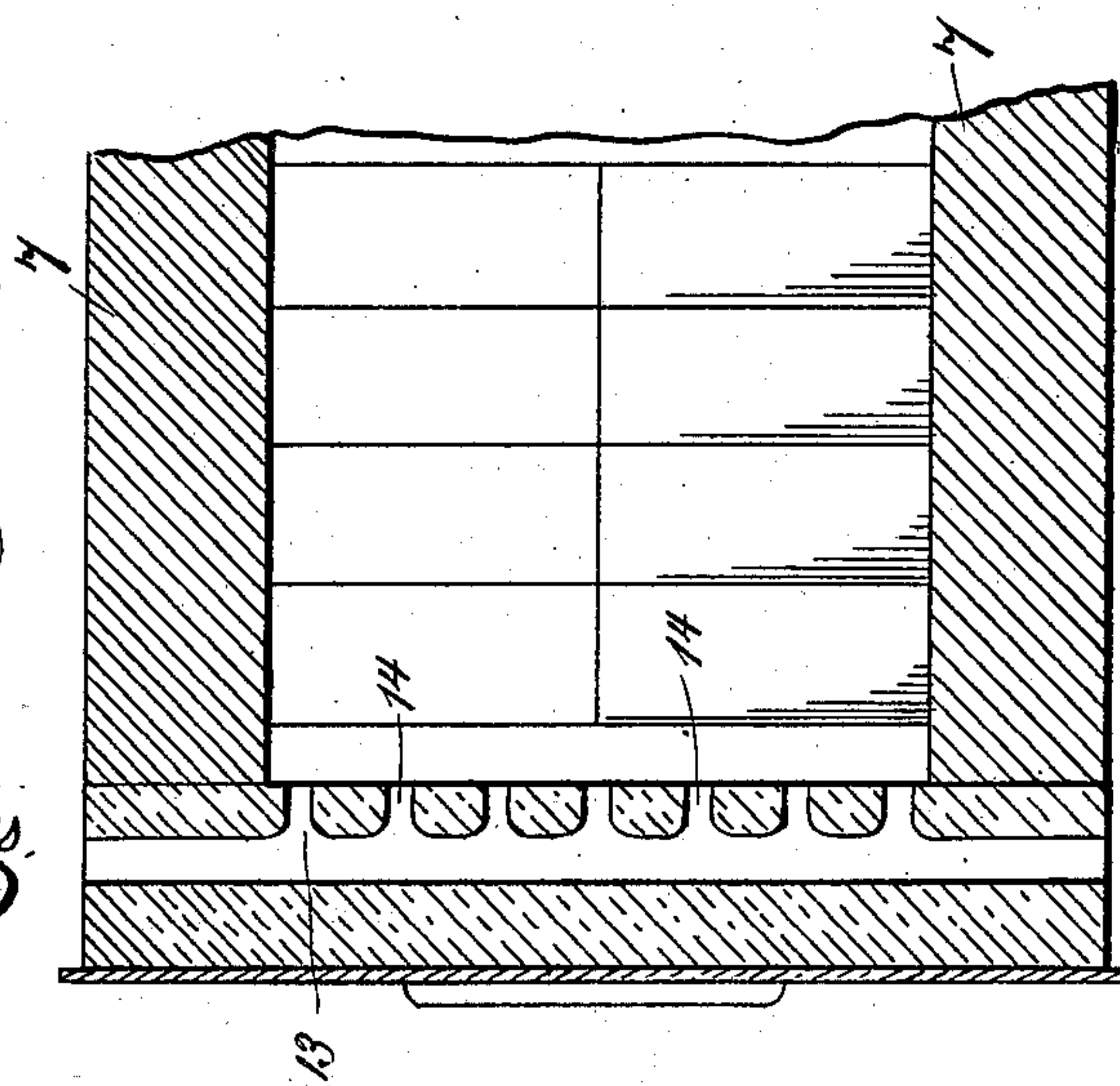


Fig. 5.

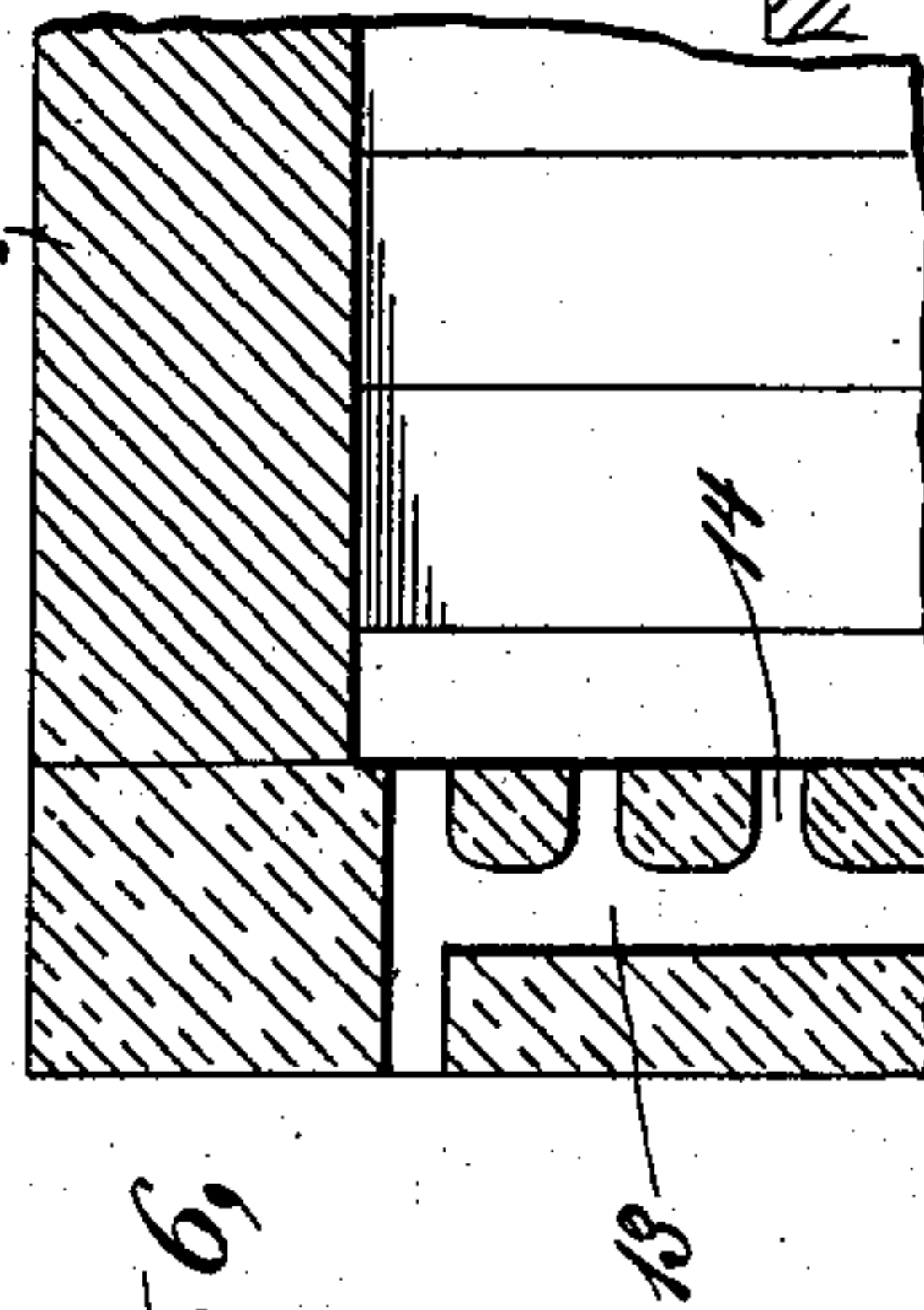


Fig. 6.

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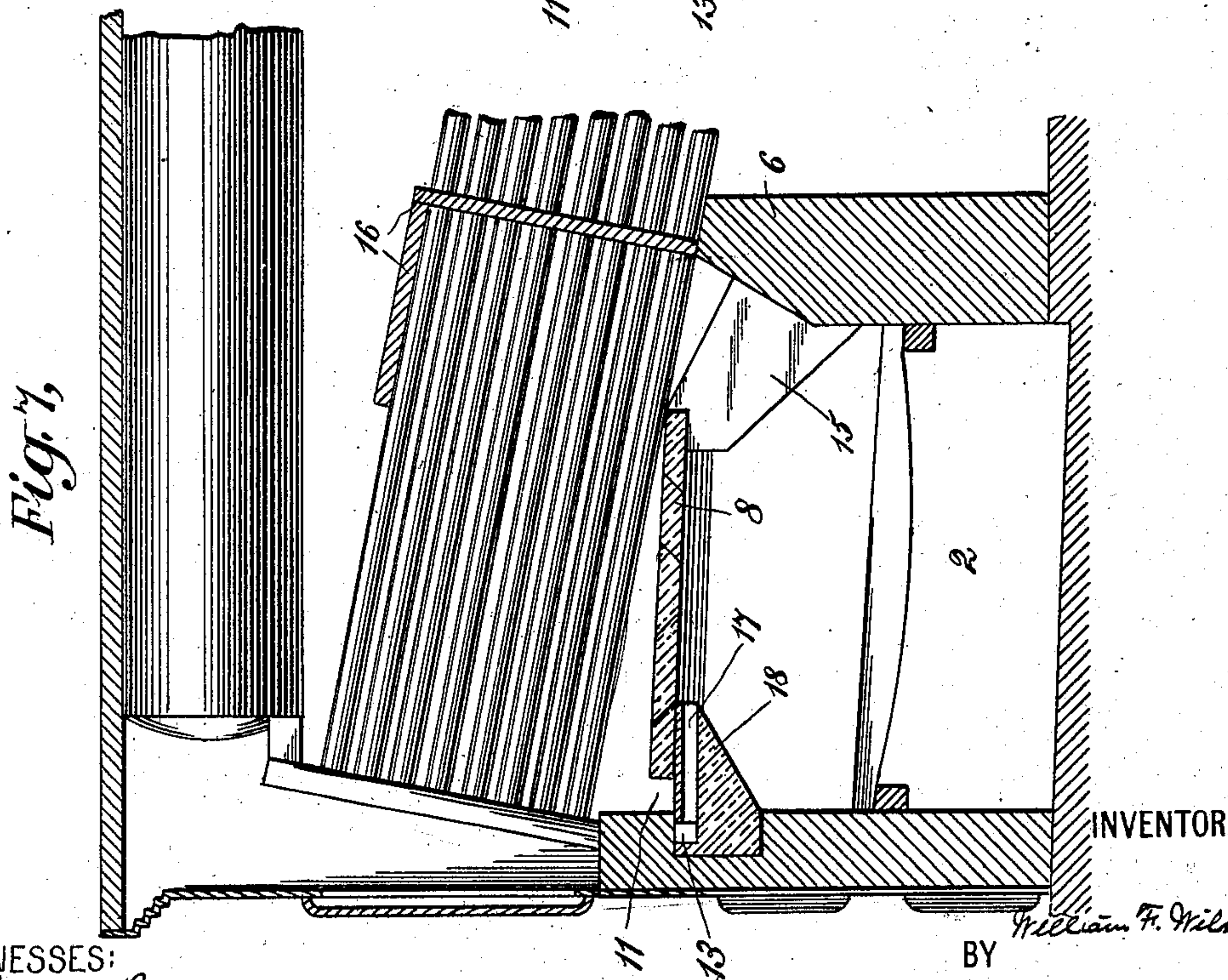
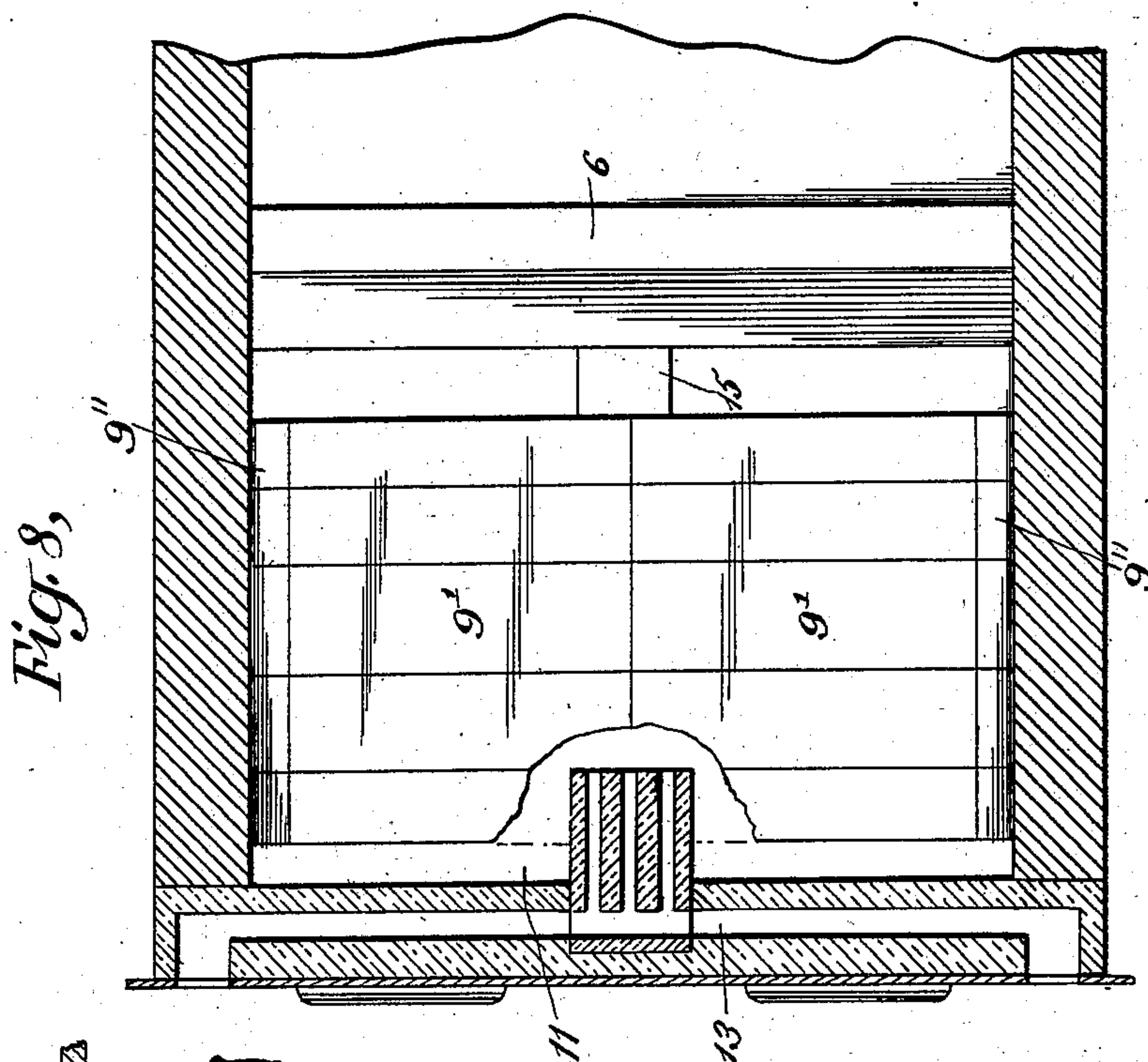
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(Application filed Oct. 18, 1901.)

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3 Sheets—Sheet 3.



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# UNITED STATES PATENT OFFICE.

WILLIAM F. WILMOTH, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN FURNACE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

## FURNACE.

SPECIFICATION forming part of Letters Patent No. 702,755, dated June 17, 1902.

Application filed October 18, 1901. Serial No. 79,176. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM FRANKLIN WILMOTH, a citizen of the United States, residing in New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in steam-boiler and other furnaces; and it consists in the novel construction of an arch over the furnace, in the novel manner of admitting air to the furnace and heating such air before contact thereof with any considerable portion of the furnace-gases, in the novel means employed for supporting a wide arch, and generally in the novel combination, construction, and arrangement of the parts.

The objects of my invention are to increase the efficiency of boiler and other furnaces, to avoid the production of smoke when using bituminous coal and other smoke-producing fuel, to avoid the objections to the use of arches over furnaces as such arches have been constructed heretofore, to render my improvements readily applicable to furnaces already built, and generally to make the furnace as simple, effective, and inexpensive as possible.

I will now proceed to describe my invention with reference to the accompanying drawings and will then point out the novel features in claims.

In the drawings, Figure 1 is a cross-section, and Fig. 2 a longitudinal section, of a boiler-furnace embodying one form of my invention, the section of Fig. 1 being taken on the line X X of Fig. 2. Figs. 3 and 4 are respectively a longitudinal and a transverse section of a boiler-furnace, showing how the arch of a wide furnace may be supported at the center. Fig. 5 is a horizontal section showing the construction of the air-flue in the front boiler-wall, said flue opening at the side. Fig. 6 is a similar view showing an air-flue opening at the front, and Figs. 7 and 8 are respectively a longitudinal section and a horizontal section showing my invention ap-

plied to a tubular boiler of the type employing longitudinal inclined generating-tubes.

My furnace comprises, as usual, a combustion-chamber 1, an ash-pit 2, with a suitable fire-door 3, and ash-pit door 4, grate-bars 5, and bridge-walls 6 at the rear of the combustion-chamber. These parts may be of ordinary construction. The furnace has also the ordinary side walls 7.

Above the furnace is an arch 8, the construction of which forms one portion of my invention. It has been common in the past to use arches over combustion-chambers of furnaces, but such arches have usually been constructed of brick and have given much trouble by falling while the furnace is in use. The arch of my furnace is constructed of cantaliver-sections 9 9, of fire-clay or other suitable material, supported by and usually set into the side walls 7 and meeting at the center, where preferably they are joined by an ordinary tongue-and-groove joint. Such an arch is exceedingly strong and will not be shaken down by jar or by vibration or by the careless handling of fire-tools, as will a brick arch the several bricks of which are supported from each other and not from the side walls of the furnace. The shape of these cantaliver-sections is important. In order that space may be economized, the arch should be flat on top, or nearly so, and should be as thin as possible, particularly at the center, where the most space is usually required. Each section must also be strong enough to support itself independently of the opposite sections, since at times it is necessary to take down one or more sections for repair or renewal. For this reason the sections of the arch taper from their points of support at the sides to or nearly to meeting point in the center. This shape affords a maximum of strength with a minimum of space occupied and also permits the use of arch-sections of greater strength than it would otherwise be practicable to use.

At the rear of the furnace there is the usual opening 10 for the escape of furnace-gases, and at the front of the furnace there is another and preferably smaller opening 11, the existence of which is important, since otherwise the efficiency of the boiler 12, heated by the furnace, is reduced, because of the cut-



ting off of the furnace-gases from the front portion of the shell of the boiler by the arch 8; but if there be an opening 11 at the front of the furnace sufficient of the furnace-gases will escape through this opening to heat effectively the front portion of the boiler. This opening 11 forms an important feature of my invention. In the front furnace-wall there is an air-flue 13, which may open at the sides of the furnace, as shown in Fig. 5, or at the front of the furnace, as shown in Fig. 6, the latter construction being necessary when boilers are set in battery. This air-flue communicates by orifices or ports 14 with the space immediately adjacent to and preferably with the space immediately above the arch 8. I find that air introduced through the flue 13 and ports 14 is very effective in increasing the efficiency of the furnace and in preventing the production of smoke. This air by traveling along the arch 8 becomes highly heated, and encountering the furnace-gases usually at the rear of the furnace assists in completing combustion in the furnace, and particularly in consuming the finely-divided particles of fuel which otherwise might become smoke.

It is well known that if cold air be introduced into a furnace above the fuel perfect combustion may be interfered with rather than helped and the fire may be deadened; but I find the contrary to be the case when air taken in, as above described, is highly heated, as above described, before encountering any considerable portion of the furnace-gases. When such highly-heated air does encounter such gases, it aids materially in effecting complete combustion within the furnace.

When the combustion-chamber of the furnace is wide, it is desirable to provide a central support for the arch 8, and for this purpose there may be a corbel 15 or other suitable support projecting from the bridge-wall 6 at the center and supporting the rear end of the arch in the manner shown in Figs. 3 and 4, and in order that the weight of those cantaliver-sections of the arch which do not rest directly on the corbel may be transmitted thereto said sections may be provided with inclined side faces, as shown in Fig. 3, so that the sections rest one upon the other, and thus the weight of sections distant from the support is transferred thereto.

When the furnace is wide, it is preferable not to set the main sections of the arch into the side walls, but to support them by means of abutment-supports, preferably skewback cantaliver-sections set into said walls. This is illustrated in Fig. 4, in which 9' designates the main sections of the arch and 9'' the skewbacks. The only reason for employing this construction is that in practice I find it difficult to obtain perfect and reliable arch-sections of a greater length than three feet. The same construction is preferably employed in the furnaces of boilers of the type shown

in Fig. 7, since these furnaces are usually very wide.

In adapting the invention to tubular boilers having longitudinal inclined generating-tubes it is important that the main body of furnace-gases shall be caused to circulate around the front portions of said tubes, and therefore baffle-plates 16 are arranged to accomplish this, as shown in Fig. 7. Since with the baffle-plates so arranged the main body of the furnace-gases travels over the top of the arch 8, the air entering the furnaces from the flue 13 is caused to pass beneath the arch instead of above it, being conducted beneath the arch by flues 17 in a block 18, set into the front of the furnace. The opening 11 is preserved to insure heating of the extreme front portions of the generating-tubes. The block 18 may form a support for the arch, corresponding in this respect to the corbel 15 of Figs. 3 and 4, but located at the front of the furnace; but the rear support may also be employed, and one is shown in Figs. 7 and 8. It will be understood that in any furnace there may be a front support for the arch or a rear support, or both a rear and front support. The width of the furnace determines whether one or more central supports shall be employed.

In the operation of the furnaces shown in the drawings the air entering through the flue 13 becomes highly heated in its passage along the arch, whether it passes above the arch or below the same, and becoming thus heated when it mingles with the furnace-gases as the end of the arch is reached it supplies to said gases a relatively fresh supply of oxygen at a temperature such that combustion may be greatly promoted thereby, and thus the greater portion of the unconsumed or incompletely-consumed gases and particles of fuel which otherwise might pass out of the chimney without being completely consumed are burned. Because of the opening 11 between the arch and the front of the furnace the front portion of the boiler is adequately heated, and thereby an objection to the employment of brick arches as heretofore constructed is overcome.

It will be noted that the invention does not involve the use of long and small flues through the arch, which are difficult to clean, nor does it involve the use of metal air-tubes, which are likely to be burned out. The air-flue in the front furnace-wall is relatively large and is easily cleaned by a steam-jet, and, moreover, the tendency of the air-current is to carry dust out of it rather than into it.

It is obvious that my invention is susceptible of many modifications in construction and arrangement of the parts and that many such modifications may be necessary to adapt it to furnaces of peculiar construction. I do not limit myself, therefore, to the particular details of construction and arrangement of parts herein illustrated and described.

In a divisional application for Letters Pat-



ent filed March 5, 1902, Serial No. 96,851, I have claimed the construction shown in Fig. 4, involving the use of skewbacks separate from the main cantaliver-sections of the arch and set into the side walls for supporting said sections, and also the construction shown in Figs 7 and 8, involving the use of means to project beneath the arch, the air entering at the front of the furnace.

10 Having thus completely described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a furnace, the combination, with furnace-walls, of an arch over the combustion-chamber composed of separable cantaliver-sections extending from the side walls to the center, supported from the side walls tapering therefrom toward the center, and joined at the center.

20 2. In a furnace, the combination with furnace-walls, of an arch over the combustion-chamber having a substantially flat top, and composed of separable cantaliver-sections set into the side walls, and extending therefrom to the center, supported from the side walls, tapering from said side walls toward the center, and joined at the center.

3. In a furnace, the combination, with furnace-walls, of a substantially horizontal arch covering the greater portion of the combustion-chamber composed of cantaliver-sections supported from the side walls and joined at the center, an opening being provided, at the front of the furnace, for the escape of a portion of the furnace-gases, and another opening at the rear for the escape of the remainder of the furnace-gases, and an air-flue at the front of the furnace which directs entering air along the surface of said arch.

40 4. In a furnace, the combination, with furnace-walls, of an arch covering the greater portion of the combustion-chamber, an opening being provided at the front of the furnace, for the escape of a portion of the furnace-gases and another larger opening being provided at the rear for the escape of the remainder of the furnace-gases, and an air-flue for admitting air to the furnace in the immediate vicinity of said arch, arranged to direct such air along the upper surface of such arch, whereby the air becomes highly heated before encountering the furnace-gases issuing through such larger opening.

5. In a furnace, the combination with furnace-walls, and a central support for an arch over the combustion-chamber of said furnace, formed of refractory material, and supported at one end only, of an arch over the combustion-chamber composed of cantaliver-sections supported from the side walls and provided with means for transferring weight from one to the other and finally to said support, by which support a portion only of the arch is directly supported.

6. In a furnace, the combination with furnace-walls, a bridge-wall, and a central support for an arch over the combustion-chamber of said furnace, formed of refractory material, projecting from the bridge-wall, and supported at one end only, of an arch over the combustion-chamber composed of cantaliver-sections supported from the side walls and provided with means for transferring weight from one to the other and finally to said support, by which support a portion only of the arch is directly supported.

7. In a furnace, the combination with furnace-walls, and a central support for an arch over the combustion-chamber of said furnace, formed of refractory material, projecting from the front wall, and supported at one end only, of an arch over the combustion-chamber composed of cantaliver-sections supported from the side walls and provided with means for transferring weight from one to the other and finally to the said support, by which support only a portion of the arch is directly supported.

8. In a furnace, the combination with furnace-walls, a bridge-wall, and independent central supports for an arch over the combustion-chamber, projecting from the front and from the bridge walls, respectively, and formed of refractory material, of an arch over the combustion-chamber composed of cantaliver-sections supported from the side walls, and provided with means for transferring weight from one to the other and finally to the said supports, by which supports portions only of the arch are directly supported.

In testimony whereof I affix my signature in the presence of two witnesses.

WILLIAM F. WILMOTH.

Witnesses:

HARRY M. MARBLE,  
A. H. PERLES.